

initially described in McCaw Chairman Craig McCaw's PCS En Banc Hearing Testimony could achieve the goal of creating an environment for in-building and on-premises systems that allows access to spectrum by multiple service providers while still providing interference protection rights.

In essence, the Part 16 proposal would extend the FCC's current Part 15 rules for non-licensed radio devices by incorporating a "spectrum etiquette" that would allow shared frequency use on a non-interference basis. The development of this spectrum etiquette would likely be accomplished through an industry standard-setting body.

While an allocation of some spectrum for exclusive Part 16 use may be necessary, this scheme also envisions sharing frequencies with existing users. Part 16 services appear to be a good example of services that would be widely used while requiring only limited spectrum resources. Any necessary exclusive allocation could be accommodated in a lightly used portion of the spectrum. Once again, proposals based upon spectrum sharing and modest impact on 2 GHz licensees, like this one, warrant careful scrutiny in this proceeding.

### 3. Other PCS Spectrum Sharing Proposals

McCaw obviously is not alone in proposing spectrum sharing technologies for the 2 GHz band. On May 11, 1992,

the Commission placed thirty-eight PCS pioneer preference requests on public notice.<sup>24</sup> Twenty-four of the thirty-eight requests seek preferences on the basis of innovations that can share or co-exist with 2 GHz licensees:

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| •Adelphia Communications Corporation   | •Omnipoint Corporation, Oracle Data Publishing, Inc., and McCaw Cellular Communications, Inc. |
| •Advanced MobileComm Technologies /FMR Corp. and Digital Spread Spectrum Technologies/CYLINK Corporation | •Omnipoint Mobile Data Company  |
| •American Personal Communications  | •Pacific Bell   |
| •American Telezone   | •PacTel Corporation   |
| •Associated PCN  | •Panhandle Telephone Cooperative, Inc.  |
| •Bell Atlantic Personal Communications, Inc.   | •PCN America  |
| •Broadband Communications Corporation  | •PCN Communications, Inc.   |
| •Corporate Technology Partners   | •Pertel, Inc.   |
| •Cox Enterprises Inc.  | •Qualcomm Inc.  |
| •Ericsson Business Communications, Inc.  | •SCS Mobilecom, Inc.  |
| •Iowa Network Services, Inc.   | •Spatial Communications, Inc.   |
| •Omnipoint Communications, Inc.  | •Telmarc Telecommunications Co.   |
|  | •Viacom International Inc.  |

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<sup>24</sup> FCC Public Notice, Pioneer's Preference Requests Accepted in GEN Docket No. 90-314, Mimeo No. 23063 (May 11, 1992).

Given the plethora of spectrum sharing opportunities now pending, the Commission would be remiss if it did not examine such issues before embarking on a forced relocation of 2 GHz licensees.

V. ABSENT SHARING, THE COMMISSION MUST DETERMINE HOW AND AT WHAT COST EXISTING USERS WILL BE ACCOMMODATED

Even as it seems to ignore the potential of spectrum sharing, the Notice appears to minimize the practical difficulties of forcing current microwave users to relocate to other bands. For one thing, the Commission has not yet had the opportunity to revise the rules governing the 4 and 6 GHz microwave bands -- the likely alternatives for 2 GHz microwave operations -- to permit an orderly migration of licensees from the 2 GHz band.<sup>25</sup> Furthermore, the OET Report understates the difficulty and expense of replacing existing 2 GHz microwave facilities. Until these deficiencies are rectified, the Commission cannot reasonably determine

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<sup>25</sup> See UTC Microwave Accommodation Petition; Comments of McCaw Cellular Communications, Inc. in the Matter of Amendment of Parts 2, 21, and 94 of the Commission's Rules To Accommodate Private Microwave Systems in the 1.71-1.85 GHz Band and in Bands Above 3 GHz, RM-7981 (filed June 1, 1992) ("McCaw Comments"); Alcatel Network Systems, Inc. Petition for Rulemaking in the Matter of Amendment of Parts 2, 21, 25 and 94 of the Commission's Rules To Accommodate Common Carrier and Private Op-Fixed Microwave Systems in Bands Above 3 GHz, RM-8004 (filed May 22, 1992) ("Alcatel Microwave Accommodation Petition").

determine whether the public interest is best served by imposing a program to clear spectrum.

A. Alternative Spectrum Must Be Readied Before Displacement Is Considered

The 2 GHz band is extensively used. According to the OET Report, over 29,000 licensed facilities operate in this band, including over 6,800 common carrier facilities in the 40 MHz allocated to those licensees between 2.11-2.13 and 2.16-2.18 GHz.<sup>26</sup> Although the Notice contemplates massive displacement of these existing users, the Commission has not yet adopted rules that would allow these users to migrate to other frequencies. Thus, existing licensees cannot even gauge what frequency bands ultimately will meet the needs of their 2 GHz operations from the standpoint of technical and eligibility compatibility. These operators instead are left wondering if they will be able to ensure that their ongoing telecommunications services will be able to proceed without intolerable interruption. Consequently, McCaw agrees with UTC that the Commission must take affirmative steps to revise its rules for the bands expected to serve as the new "homes" for displaced 2 GHz facilities.<sup>27</sup> Such amendments

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<sup>26</sup> OET Report at 8, 18-19.

<sup>27</sup> See McCaw Comments.

are a necessary prerequisite to any decision to displace existing licensees.

B.    The OET Report Underestimates the Costs,  
          Burdens, and Obstacles in Relocating Cellular  
          2 GHz Microwave Operations

The OET Report significantly underestimates the costs and burdens associated with displacing existing users, particularly common carrier licensees, thus providing the Commission with an imperfect picture of the consequences of spectrum clearing.

1.    Cellular 2 GHz Equipment Is Relatively New

As noted in the OET Report, the influx of cellular licensees into the 2 GHz band has skewed the age distribution of all 2 GHz equipment.<sup>28</sup> The study first concluded that the average age of 2 GHz basic microwave communications equipment used by private licensees is 7.5 years.<sup>29</sup> Substantial growth in common carrier facilities, however, primarily cellular in nature, has translated into a younger average age of this equipment. The OET Report determined that the average age of common carrier facilities is five years, while "half of the equipment used in this

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<sup>28</sup>    OET Report at 32.

<sup>29</sup>    Id.

service is under three years old."<sup>30</sup> As described above, over half of McCaw's 2 GHz microwave radios are even newer, being less than two years old.

As a result, this equipment is near the beginning of its useful life. The licensees of these facilities, including McCaw, have reasonably expected that such equipment would be operational for that useful life.<sup>31</sup> Thus, the costs for any relocation of cellular licensees of 2 GHz spectrum will be more substantial than would be the case with equipment nearer the end of its life cycle.

2. Some Existing 2 GHz Microwave Paths Simply Cannot Be Relocated

The OET Report concludes that the primary relocation bands at 4 GHz and 6 GHz can adequately substitute for existing 2 GHz facilities by accommodating desired path length requirements and reliability standards.<sup>32</sup> McCaw agrees that 4 GHz and 6 GHz frequencies could replace some of its 2 GHz facilities if equipment standards, channelization plans, and modulation rules were adopted to accommodate its present 2 GHz operations.

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<sup>30</sup> Id.

<sup>31</sup> McCaw believes that the typical useful life of the "frequency sensitive" facilities is about 15 years. See OET Report at 31-32.

<sup>32</sup> See OET Report at 15-28.

The OET Report and the Notice fail to understand, however, the full scope of the practical problems that would confront 2 GHz licensees forced to vacate those operations. There are situations where no alternative to 2 GHz microwave exists. These cases arise where zoning, environmental, or terrain considerations preclude use of higher microwave bands or landline facilities.

Zoning. Cell sites and associated microwave facilities must be located consistent with local zoning restrictions. As the OET Report recognizes, replacement frequencies may necessitate the installation of new towers or the modification of existing supporting structures.<sup>33</sup> Alternatively, it may be necessary to install a multi-hop path in place of what is now a single hop link, thus requiring the installation of new transmitters and a tower. In some instances, local zoning approvals may not be obtainable.

Zoning issues are becoming an increasingly controversial matter for local governments. In some markets, McCaw already is confronted with a reluctance to

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<sup>33</sup> See OET Report at 31, 33. Terrain, distance, and capacity are all factored into antenna size. At longer distances and with varying terrain, 6 GHz frequencies would require larger and multiple antennas when compared to 2 GHz operations. Local zoning authorities are often reluctant to approve the replacement of small dish antennas with the large conspicuous drum antennas required for operation at higher frequencies.

permit the construction of facilities necessary to provide cellular service and achieve microwave interconnection. Such factors currently play a role in system design and construction. With the increasing number of radio-based services on the horizon, the situation is likely to get worse.

Environmental. In order to provide service throughout a market, McCaw has often found it necessary to route microwave paths across national or state forests or over protected park land or scenic areas. In those cases, site locations are severely curtailed as the responsible federal or state government agency seeks to limit activities and installations that might detract from the natural surroundings. As a result, McCaw may be unable to add new radio sites or modify existing antennas and structures so as to accommodate different microwave facilities.

Terrain. There are cases where natural barriers, such as water, swamps, rivers, or natural preserves, determine the design of microwave paths.<sup>34</sup> These natural barriers may dictate path length and tower site location. Alternative bands may not be able to complete the required

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<sup>34</sup> As the OET Report acknowledges, the 2 GHz band is best suited to achieving successful radio transmission when crossing bodies of water. OET Report at 16-17.



communications link. In addition, fiber optic and other landline facilities may not be available in such areas.<sup>35</sup>

3. OET's Estimates of the Costs of Relocation  
Do Not Fully Reflect the Costs of the  
Changeovers for Cellular Carriers or Their  
Subscribers

The OET Report offers an estimate of both the lost value due to replacement of 2 GHz equipment before the end of its useful life and the cost of conversion to frequency bands above 3 GHz.<sup>36</sup> Specifically, that report found that only basic microwave communications equipment, such as radio terminal equipment, antennas, and necessary feed lines (referred to as "frequency sensitive" equipment), would need to be replaced. Assuming an average cost of \$125,000 per transmitter, an average age of equipment of five years, and an average equipment life of 15 years, the OET Report concluded that common carrier licensees would lose \$83,000

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<sup>35</sup> Beyond these situations, McCaw anticipates encountering circumstances where it will not be possible to coordinate use of higher band frequencies to replace existing operations. This may result from the particular pattern of frequency use in the vicinity of the target path or various terrain characteristics. Similarly, McCaw has entered into agreements with a Canadian cellular carrier to facilitate seamless service between cellular systems in both countries. To implement those plans, McCaw employs microwave facilities. There are border markets where 2 GHz frequencies are the only ones that are compatible with the interconnected operations of McCaw's Canadian partner.

<sup>36</sup> OET Report at 31-33.

in the value of their 2 GHz equipment if they were forced to convert immediately to higher band operation.<sup>37</sup>

The OET Report determined that "[t]he cost of transmitters, receivers and replacement antennas of the same level of operation on frequencies above 3 GHz is similar to the cost of 2 GHz radio terminal equipment, e.g., \$125,000 to \$150,000."<sup>38</sup> The study found that "the average costs per facility of frequency coordination, antenna upgrades, improvements to antenna structures and other relocation costs would be approximately \$25,000."<sup>39</sup>

Based on its studies, OET then concluded that, if existing facilities are converted to new frequency bands only at the conclusion of the equipment life cycle, the cost per average facility would be \$25,000.<sup>40</sup> If conversion were immediately effectuated, common carriers would suffer an

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<sup>37</sup> Id. at 32.

<sup>38</sup> OET Report at 32. Given this comparable estimate, OET in effect can ignore these substitution costs, since equipment to replace 2 GHz facilities at the end of their useful life would cost the licensee about the same.

<sup>39</sup> OET Report at 33. Frequency coordination studies range from \$300 to \$3,500. If high performance antennas are needed in order to achieve successful frequency coordination in the 4 to 6 GHz bands, their price ranges from \$3,000 to \$30,000. The report acknowledged that deployment of the heavier high performance antennas often would necessitate new or reinforced support structures, at a cost from \$1,000 to \$20,000.

<sup>40</sup> OET Report at 33.

additional average cost of \$83,000 per facility for the lost value of the 2 GHz equipment.<sup>41</sup>

McCaw believes these estimates greatly understate the actual costs that would be imposed. Based on McCaw's experience and information gained from its suppliers, the report underestimated costs or ignored certain elements. Also, reliance on "average" costs may vastly underrepresent the actual costs imposed on a licensee with several hundred facilities, like McCaw, whose individual relocation situations may involve costs at the high end of the range identified by OET.

First, the OET Report assumes an average equipment age of five years (for common carriers). For McCaw, 95 percent of its 2 GHz equipment is less than five years old. Indeed, as noted earlier, 54 percent of McCaw's 2 GHz equipment is two years old or less.

Second, after acknowledging that 2 GHz frequency sensitive equipment would on average cost \$125,000 to \$150,000, the OET Report uses the lower end of this range for its calculations -- with no explanation for this choice.

Third, the OET Report found that higher band microwave facilities may need larger or high performance antennas in

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<sup>41</sup> Id.

some areas to meet interference criteria.<sup>42</sup> The OET Report states that the majority of existing high performance antennas operated in the 4 to 6 GHz band are the more expensive types in the range from \$3,000 to greater than \$30,000, yet then uses a price differential of only \$15,000 for calculating average costs.<sup>43</sup>

Fourth, the OET Report does not account for the cost of adding space diversity antennas necessary to meet reliability and performance standards designed to satisfy customer needs. It is McCaw's experience that 6 GHz frequencies are more susceptible to deep fades and require the use of space diversity antennas.<sup>44</sup> Obviously, the use of space diversity antennas results in additional costs associated with the relocation.

Fifth, the OET Report estimates that, at \$40,000 per mile, "fiber could replace a 7 mile two way microwave

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<sup>42</sup> Such facilities may be needed on the licensee's own path or may need to be installed for other licensees in order to permit interference-free operations.

<sup>43</sup> Id. at 33. A standard 1 to 2 meter 2 GHz antenna costs much less, usually between \$900 and \$2,000.

<sup>44</sup> As the Commission is aware, atmospheric and meteorological conditions will tend to bend or refract a travelling radio wave. This generally results in a reduced signal level received at the antenna. To avoid a loss of service during such "fades", a second receive antenna is constructed on the same tower. The basic theory is that, at any given time, a signal on one path may be in a condition of fade while the identical signal on another path may not.

facility for approximately the same total cost"<sup>45</sup> or \$300,000. This estimate is simply incorrect, because it fails to address the total costs of obtaining equipment for fiber and its maintenance. The cost of fiber alone would be \$100 a foot. Added to the costs of the end equipment, between \$80,000 to \$100,000, and installation costs of \$40,000 a mile, fiber no longer appears to be a comparable replacement for existing microwave links.<sup>46</sup>

Sixth, OET's estimates do not account for the substantial costs that may be incurred to convert a single hop path to a multiple hop link. As even the OET Report seems to acknowledge, there will be situations where it is necessary to add transmit/receive facilities to link the existing endpoints.<sup>47</sup>

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<sup>45</sup> OET Report at 29-30.

<sup>46</sup> All this ignores the fact that deployment of fiber requires right of way access that cellular carriers do not enjoy. In fact, McCaw recently attempted to install a seven mile fiber link in Portland, Oregon and was forced to abandon the project after working unsuccessfully for two years to obtain rights of way. To accommodate fiber use as a 2 GHz microwave replacement, the Commission might well find it necessary to preempt local regulation requiring some sort of franchise as a prerequisite to installation of the facilities.

<sup>47</sup> See OET Report at 15. There may be technical reasons (such as terrain, existing frequency use in the area, and propagation characteristics) for this, but other constraints may play a role. For example, zoning limitations may prevent the installation of the facilities necessary to allow a single hop path. Similarly, locations on park lands may be hampered in their ability to make a direct conversion with the same sites to new frequencies.

Seventh, OET makes no mention of the planning and resource costs imposed on a carrier required to redesign its 2 GHz microwave facilities. McCaw has estimated that it will take nearly 60,000 man hours to engineer and convert all of its 2 GHz facilities to a higher frequency.

Eighth, lost opportunities are not accounted for in the OET Report. To the extent that McCaw must focus on relocating 440 2 GHz microwave facilities, its employees and resources will be diverted from building out its cellular systems in order better to meet customer needs.

Ninth, the OET Report assumes that 2 GHz equipment simply can be swapped with the higher band equipment. In practice, however, to do a straight facilities transfer in that manner could require that service be shut down for 12 to 48 hours, thus disrupting the provision of cellular service relied upon by the public. To maintain service while replacing the equipment will substantially increase the transition costs.<sup>48</sup>

Finally, the conversion estimates ignore costs associated with obtaining necessary FCC approvals to

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<sup>48</sup> Also, it is McCaw's experience that it cannot be certain that a microwave facility will actually work on the proposed path until the radios are turned on. Thus, while the paper calculations may show likely successful operation, there may be situations where the actual field experience will require a further reengineering of the microwave path and frequencies. If the replacement frequencies do not work, further costs would be imposed to seek another suitable alternative.

implement the relocation. For a carrier like McCaw with a large number of 2 GHz paths, the filing fees, preparation charges, attorneys fees, and delivery costs can quickly add up.<sup>49</sup> Moreover, if all of the relocation applications must be processed nearly simultaneously by the Commission's staff, action on those applications as well as all others involving Part 21 facilities will be delayed.<sup>50</sup> This in turn will seriously hinder the ability of carriers to operate their businesses effectively and to meet consumer needs.

VI. EXISTING 2 GHZ LICENSEES SHOULD NEVER BE FORCIBLY RELOCATED, BUT SHOULD MOVE ONLY UPON REACHING AGREEMENT WITH THE NEW LICENSEES IN THIS BAND

The Commission currently is in a situation where it has proposed to disrupt existing 2 GHz operations in favor of new technologies and services that have not been identified with a plan for relocation to frequency bands whose rules do not currently accommodate the existing uses. Opportunities for successful sharing of spectrum between the existing operations and the new services remain only poorly explored.

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<sup>49</sup> The FCC should consider waiving its filing fees for applications necessitated by any reallocation order in this docket.

<sup>50</sup> Such delays occurred when Part 21 renewal applications were filed. Now, the filing of the 24,000 MDS applications apparently has led to substantial delays in the processing of all other Part 21 applications.

Existing common carriers face costs far in excess of those estimated in the OET Report, given its failure to comprehend many of the practical issues involved in the systems restructuring contemplated by the Notice.

These factors support the conclusion that the Commission should allow existing 2 GHz licensees to remain in operation on a primary basis until the licensee decides to relocate.<sup>51</sup> The new technologies licensees would be free -- in fact would be encouraged -- to negotiate with the existing operators to the extent that exclusive access to spectrum is needed.<sup>52</sup> By not terminating the primary status of the 2 GHz user, it would have some mutuality of negotiating status with the new services providers.

In order to facilitate any voluntary relocation, the Commission must first act on the proposals to adopt revised channelization plans, eligibility requirements, and other rule amendments for the so-called replacement microwave

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<sup>51</sup> See also Schelle Testimony at 5 ("If, however, no suitable alternative frequencies can be located in the particular case, the microwave user could remain in the 2 GHz band indefinitely.").

<sup>52</sup> This approach has been advocated by the Chairman of APC. As recently as June 3, 1992, he stated that "PCS licensees would be required to bear the full cost of relocation of an incumbent microwave user to other, equally suitable, frequencies." Schelle Testimony at 4.



bands.<sup>53</sup> Such action is a necessary prerequisite for establishing the environment in which the parties are willing to explore mutually acceptable negotiations. If an existing 2 GHz licensee has no practical alternatives, it will not want to sell out; but if those alternatives are fostered by the Commission, the situation will be more conducive to a negotiated resolution.

Indeed, payments by the providers of future services based on emerging technologies are properly treated as part of the start up costs for these new facilities and services. Accordingly, the policies adopted by the Commission should ensure that the beneficiaries of such activities shoulder any burden they impose on existing 2 GHz licensees.

In the Notice, the Commission states its intention to pursue the proposed "reallocation in a manner that will minimize disruption of the existing 2 GHz fixed operations."<sup>54</sup> That goal is best achieved by allowing the existing users to retain their primary status<sup>55</sup> unless and

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<sup>53</sup> E.g., UTC Microwave Accommodation Petition; Alcatel Microwave Accommodation Petition. McCaw expects that other proposals likely will be offered in the comments in this proceeding.

<sup>54</sup> Notice, 7 FCC Rcd at 1544.

<sup>55</sup> This means that any subsequent licensees would have to provide full frequency protection to existing users of the 2 GHz spectrum. It is Mr. Schelle's belief that, "[w]ithout question, the FCC will not authorize any new service in the new 2 GHz band without establishing strict rules to protect  
(continued...)

until they voluntarily decide to relocate or replace their facilities.

## VII. CONCLUSION

In this proceeding, the Commission is confronting the difficult challenge of allocating spectrum for emerging telecommunications technologies that have not yet been specifically defined. In light of the tremendous costs associated with relocation of existing users, both in terms of time and resources, McCaw believes that this goal must be achieved by first focusing on spectrum sharing technologies that avoid costly displacements of licensed users. In fact, the OET Report and the Notice fail to recognize the full extent of the burdens and adverse consequences for 2 GHz licensees, especially those cellular common carriers who have extensive microwave networks. Accordingly, the Commission should grant indefinite protected primary status to existing 2 GHz users. Such entities should be required

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<sup>55</sup>(...continued)  
existing users from harmful interference." Schelle Testimony at 6.

to relocate only upon reaching satisfactory arrangements  
with future users of the band.

Respectfully submitted,

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